Lloyd's Register

Rules and Regulations for the Classification of Naval Ships, January 2009

Notice No. 3

Effective Date of Latest Amendments:

See page 1

Issue date: August 2009

RULES AND REGULATIONS FOR THE CLASSIFICATION OF NAVAL SHIPS, *January 2009*

Notice No. 3

This Notice contains amendments within the following Sections of the *Rules and Regulations for the Classification of Naval Ships, January 2009.* The amendments are effective on the dates shown:

Volume	***Part***	***Chapter***	***Section***	***Effective date***
1	1	2	3, 4	1 January 2010
1	1	3	2, 7	1 January 2010
1	4	1	6	1 January 2010
1	6	6	4	Corrigenda
2	1	1	4, 9	1 January 2010
2	1	2	2, 3, 5	1 January 2010
2	1	5	New Chapter	1 January 2010
2	2	1	2, 5, 6, 7, 15	1 January 2010
2	2	2	2, 4, 5, 7	1 January 2010
2	7	1	5, 11, 13	1 January 2010
2	7	4	1	1 January 2010
2	7	5	1, 11	1 January 2010
2	9	1	1, 2	1 January 2010
2	10	1	1, 3, 6, 7, 8, 10, 13, 14, 16	1 January 2010
2	11	1	1, 3	1 January 2010
2	11	2	1, 3	1 January 2010
2	11	3	1	1 January 2010
3	1	3	5	1 January 2010
3	1	4	1, 3, 5	1 January 2010
3	1	7	5	1 January 2010
3	2	1	2, 4, 5, 8	1 January 2010
3	2	3	1	1 January 2010

It will be noted that the amendments also include corrigenda, which are effective from the date of this Notice.

The *Rules and Regulations for the Classification of Naval Ships, January 2009* are to be read in conjunction with this Notice No. 3. The status of the Rules is now:

Rules for Naval Ships	Effective date:	January 2009
Notice No. 1	Effective dates:	1 April 2009 & Corrigenda
Notice No. 2	Effective dates:	1 January 2009, 1 July 2009, 1 January 2010 & Corrigenda
Notice No. 3	Effective dates:	1 January 2010 & Corrigenda

Volume 1, Part 1, Chapter 2
Classifications Regulations

Effective date 1 January 2010

■ *Section 3*
Character of Classification and Class notations

3.8 Machinery and Engineering Systems notations

Table 2.3.2 Machinery Class Notations (*Part only shown*)

Machinery Notations *See* 3.8
~~**NAV**~~ ~~Navigation equipment~~ **NAV1** Navigation equipment

3.8.4 The following class notations are associated with navigation safety, and may be assigned:

NAV1 This notation will be assigned when ~~a superior~~ the bridge layout and level of equipment are such that the ship is considered suitable for safe periodic operation under the supervision of a single watchkeeper on the bridge. It denotes that the navigational installation has been arranged, installed and tested in accordance with LR's Rules, or is equivalent thereto.

IBS This notation will be assigned where an integrated bridge system is fitted to provide electronic chart display, track planning and automatic track following, centralised navigation information display, and bridge alarm management. It denotes that the integrated bridge system has been arranged, installed and tested in accordance with LR's Rules, or is equivalent thereto. For assignment of this notation, in addition to satisfying LR Rules, or equivalent thereto, for navigational function integration:

(a) the layout of the bridge and the equipment located on the bridge is to satisfy the requirements of a relevant Naval, International or National ergonomic or human-centred design standard, or an acceptable equivalent, to the satisfaction of LR; or

(b) the notation **NAV1** is also to be assigned; or

(c) where the bridge is not intended to operate a periodic one man watch, the layout of the bridge and the equipment on the bridge are to satisfy the requirements for the assignment of the notation **NAV1** to the satisfaction of LR with the exception of requirements identified by LR Rules that may be relaxed in such cases.

■ *Section 4*
Surveys – General

4.5 Existing ships – Periodical Surveys

4.5.22 Where the ship is fitted with ~~classed~~ a dynamic positioning ~~equipment~~ system, the system is to be examined and tested annually in accordance with the requirements of ~~Ch 3,2.3.12~~ Ch 3,2.3.15. In addition a Special Survey is to be carried out at intervals not exceeding five years in accordance with Ch 3,7.2.9.

Volume 1, Part 1, Chapter 3
Periodical Survey Regulations

Effective date 1 January 2010

■ *Section 2*
Annual Surveys – Hull, machinery and optional requirements

2.3 Machinery

~~*2.3.15* For ships fitted with a classed dynamic positioning system and/or classed thruster assisted positional mooring system, the control system and associated machinery items are to be generally examined and tested under operating conditions to an approved Test Schedule.~~

2.3.15 On ships fitted with a dynamic positioning system, the control system and associated machinery items are to be generally examined and tested to demonstrate that they are in good working order.

~~*2.3.16* For ships fitted with positional mooring equipment in accordance with the Rules, a schedule or rota of moorings to be examined at Annual Survey should be agreed for component parts of the positional moorings.~~

2.3.16 For ships assigned with **NAV1** and/or **IBS** class notations, Annual Surveys are to be carried out in accordance with the approved test schedule as required by Vol 3, Pt 1, Ch 4,1.2.1 to ascertain that the equipment and arrangements required for the applicable class notation(s) are being maintained in good working order. At the time of the survey, relevant statutory or Naval Authority Certificates may be accepted as evidence of satisfactory operation.

■ *Section 7*
Machinery survey – General requirements

7.2 Complete Survey

~~*7.2.9* On vessels fitted with a classed dynamic positioning system the control system and associated machinery items are to be examined and tested to demonstrate that they are in good working order.~~

7.2.9 For ships fitted with a dynamic positioning system, the control system and associated machinery items are to be examined and tested under operating conditions to an approved Test Schedule.

Volume 1, Part 4, Chapter 1
Military Design

Effective date 1 January 2010

■ *Section 6*
Magazine design and construction

6.8 Piping, cabling and electrical systems

6.8.1 In order to eliminate potential sources of ignition in a magazine in which flammable mixtures are liable to collect, hazardous areas for magazines are to be identified and electrical equipment within the magazine is to be selected and installed in accordance with the requirements of Vol 2, Pt 10, Ch 1,13.

Volume 1, Part 6, Chapter 6
Material and Welding Requirements

CORRIGENDA

■ *Section 4*
Welded joints and connections

4.5 Fillet welds

Table 6.4.1 Weld factors (*see continuation*) (*Part only shown*)

Item	Weld factor	Remarks
(1) General application:		except as required below
Watertight plate boundaries	0,34	
Non-tight plate boundaries	0,13	
Longitudinals, frames, beams, and other secondary members to shell, deck or bulkhead plating	0,10 0,13 0,21	 in tanks in way of end connections
Panel stiffeners, etc.	0,10	
Overlap welds generally	0,27	
Longitudinals of the flat-bar type to plating		*See* 4.5.5
(2) Bottom construction in way of tanks:		
Non-tight centre girder: to keel to inner bottom	0,27 0,21	 no scallops
Non-tight boundaries of floors, girders and brackets	0,21 0,27	in way of 0,2 x span at ends in way of brackets at lower end of main frame
Inner bottom longitudinals or reverse frames	0,13	
Connection of floors to inner bottom in way of bulkheads, supported on inner bottom. The supporting floors are to be continuously welded to the inner bottom	0,44	weld size based on floor thickness weld material compatible with floor material ~~See Note 4~~
(3) Hull framing:		
Webs of web frames and stringers: to shell to face plate	 0,16 0,13	
Tank side brackets to shell and inner bottom	0,34	
(4) Decks and supporting structure:		
Strength deck plating to shell		as shown in Table 6.4.5 but alternative proposals will be considered
Other decks to shell and bulkheads (except where forming tank boundaries)	0,21	generally continuous
Webs of cantilevers to deck and to shell in way of root bracket	0,44	
Webs of cantilevers to face plate	0,21	
Pillars: fabricated end connections end connections (tubular)	0,10 0,34 full penetration	 *see* Note ~~1~~
Girder web connections and brackets in way of pillar heads and heels and end brackets	0,21	continuous
Girder web connections general	0,1	

Volume 2, Part 1, Chapter 1

General Requirements for Classification of Engineering Systems

Effective date 1 January 2010

■ *Section 4* Engineering system classification principles

4.6 Through life operation principles

4.6.7 Operating and maintenance manuals for all engineering systems are to be provided on board and submitted to LR for information where requested and are to include the following information:

(a) Particulars of engineering systems.

(b) Operating instructions for all engineering systems. Including recommended continuous operating design limits.

(c) Maintenance instructions for engineering systems and equipment.

(d) Instructions for normal and reversionary modes of operation for machinery and equipment in mobility and ship type engineering systems, *see* Ch 2,3.3.19.

■ *Section 9* Type approval system (for information)

9.1 General

9.1.3 Details of LR's Type Approval System are contained in the following LR publications:

- (a) Procedure ~~TA96~~ TA02.
- (b) Test Specification 1: Electrical and Control Engineering Products which are Environmentally Tested.
- (c) Test Specification 2: Piping System Components.
- (d) Test Specification 3: Electrical products that do not require Environmental Testing.
- (e) Test Specification 4: Internal Combustion Engines.
- (f) Test Specification ~~GT98~~ GT04: Gas Turbines.

Volume 2, Part 1, Chapter 2

Requirements for Design, Construction, Installation and Sea Trials of Engineering Systems

Effective date 1 January 2010

■ *Section 2* General provisions

2.1 Provisions

2.1.7 Any novelty in the design and/or construction of machinery, boilers, pressure vessels or engineering equipment is to be advised to LR (*see also* Vol 2, Pt 1, Ch 5).

■ *Section 3* Particulars to be submitted

3.3 Calculations and specifications

3.3.6 **Machinery Fastening**.

(a) ~~Documentary~~ For NS3 type ships or where specified by the Naval Authority, documentary evidence and calculations indicating that machinery is securely mounted for the ship motions and accelerations to be expected during service.

(b) ~~Calculations~~ For NS3 type ships or where specified by the Naval Authority, calculations to demonstrate that mountings of large masses such as main engines, auxiliary engines and electrical equipment can withstand the design collision acceleration according to 5.4.1 without fracturing.

(c) Plans showing the arrangement of resiliently mounted machinery which are to indicate the number, position, type and design of mounts.

(d) Natural frequency calculation of resilient mounted machinery.

(e) Plans showing the arrangement of resin chocks for machinery requiring accurate alignment with the following information:

(i) Resin type.

(ii) The effective area and minimum thickness of the chocks.

(iii) The total deadweight loading of machinery.

(iv) The thrust load, where applicable, that will be applied to the chocked item.

(v) The loading to be applied to the holding-down bolts.

(vi) The material of the holding-down bolts.

(vii) The number, thread size, and waisted shank diameter (where applicable) of the holding-down bolts.

See 5.3~~, 5.4 and 5.5~~ to 5.6 for requirements.

■ *Section 5*
Machinery space arrangements

5.3 Machinery fastenings

5.3.1 Bedplates, thrust seatings and other fastenings are to be of robust construction, and the machinery is to be securely fixed to the ship's structure to the satisfaction of the Surveyor. For NS3 type ships or where specified by the Naval Authority, the arrangement is to be such that is sufficient to restrain the dynamic forces arising from vertical and horizontal acceleration appropriate to the intended service, *see* 3.3.6 and 5.4.

5.4 Collision load

5.4.1 Unless an accurate analysis of the collision load is submitted and found acceptable by LR, the collision load is to be determined from:

$$g(\text{collision}) = 1{,}2\,\frac{P_{coll}}{\Delta g}$$

where the load P_{coll} is taken as the lesser of:

P_{coll} = 460 $(M\,C_L)^{2/3}\,(E\,C_H)^{1/3}$ kN

P_{coll} = 9000 $M\,C_L\,[C_H\,(T + 2)]^{1/2}$ kN

where

C_H = a factor given in Table 2.5.1

$C_L = \dfrac{(165 + L_{WL})}{245}\left(\dfrac{L_{WL}}{80}\right)^{0,4}$

D = ship depth, in metres, from the underside of keel amidships to the top of effective hull girder

E = 0,5Δ V^2 kNm

H_T = minimum height, in metres, from tunnel or wet-deck bottom to the top of effective hull girder for catamarans and surface effect ships
= D for air cushion vehicles

L_{WL} = ship waterline length, in metres

M = 1,3 for high tensile steel
= 1,0 for aluminium alloy
= 0,95 for mild steel
= 0,8 for fibre reinforced plastics

T = buoyancy tank clearance to skirt tip, in metres, (negative) for ACVs
= lifted clearance from keel to water surface, in metres, (negative) for hydrofoils
= ship draught to the underside of keel amidships, in metres, for all other ships

V = operational speed of ship, in m/s

g = gravitational acceleration = 9,806 m/s^2

Δ = ship displacement, to be taken as the mean of the lightweight and maximum operational weight, in tonnes.

Existing sub-Sections 5.4 *to* 5.12 *are to be renumbered* 5.5 *to* 5.13.

~~5.4~~ 5.5 Resilient mountings

~~5.5~~ 5.6 Resin chocks

~~5.6~~ 5.7 Ventilation

~~5.7~~ 5.8 Fire protection

~~5.8~~ 5.9 Means of escape

~~5.9~~ 5.10 Communications

~~5.10~~ 5.11 Personnel safety

~~*5.10.6*~~ *5.11.6* Materials used in the construction of machinery and installation of engineering systems are not to be a ~~recognized~~ recognised hazard to personnel. This includes the prohibition of asbestos except in the following applications where agreed by LR and the Naval Authority:

(a) Vanes used in rotary vane compressors and rotary vane pumps;

(b) Watertight joints and linings used for the circulation of fluids when at high temperature (in excess of 350ºC) or pressure (in excess of ~~7 x 10^6 Pa~~ 70 bar (7 MPa)) there is a risk of fire, corrosion or toxicity;

(c) Supple and flexible thermal insulation assemblies used for temperatures above 1000ºC.

~~5.11~~ 5.12 Machinery enclosures

~~5.12~~ 5.13 Fire detection, alarm and extinguishing arrangements

Table 2.5.1 Factor C_H

Factor C_H	Catamarans, SES	Mono-hulls, H'Foils	ACVs
C_H	$\dfrac{T + 2 + f\,(D/2)}{2D}$	$\dfrac{T + 2 + f\,(D/2)}{2D}$	$\dfrac{f}{4}$
where f = 0 for f = 1 for f = 2 for	 $T + 2 < D - H_T$ $D > T + 2 \geq D - H_T$ $T + 2 \geq D\,M$	 $T + 2 < D$ $T + 2 \geq D$ —	 — $H_T > 2$ $H_T \leq 2$

Volume 2, Part 1, Chapter 5

Requirements for Machinery and Engineering Systems of Unconventional Design

Effective date 1 January 2010

■ *Section 1*
Requirements for machinery and engineering systems of unconventional design

1.1 General – Scope and objectives

1.1.1 The requirements of this Section aim to ensure that risks to maritime safety and the environment, stemming from the introduction of machinery or engineering systems of unconventional design, are addressed insofar as they affect the objectives of naval classification.

1.1.2 The requirements of this Section are to be satisfied where machinery is required to be constructed, installed and tested in accordance with Lloyd's Register's (hereinafter referred to as 'LR') Rules and Regulations and for which the corresponding machinery class notation is to be assigned, *see* Vol 1, Pt 1, Ch 2,3.8.

1.1.3 The requirements apply to machinery and engineering systems considered by LR to be of unconventional design and which, as a result, are not directly addressed by LR's extant Rules and Regulations. It should be noted however, that the general requirements of LR's Rules and Regulations are to be satisfied as applicable.

1.1.4 Compliance with ISO/IEC15288 *Systems Engineering – System Life Cycle Processes* or an acceptable equivalent National Standard may be accepted as meeting the requirements of 1.3 to 1.11.

1.2 Information to be submitted

1.2.1 Information is to be submitted for assessment of compliance with the general requirements of LR's Rules and Regulations, including the general requirements for:

(a) Machinery, *see* Pt 1, Ch 1 and Ch 2;
(b) Steam raising plant and pressure vessels *see* Pt 8, Ch 1 and Ch 2;
(c) Machinery and ship piping systems, *see* Pt 7, Ch 2, Ch 3 and Ch 5;
(d) Control engineering, *see* Pt 9, Ch 1;
(e) Electrical engineering, *see* Pt 10, Ch 1;
(f) Materials, *see the Rules for the Manufacture, Testing and Certification of Materials*.

1.2.2 In addition to the information identified in 1.2.1, the information described in 1.2.3 and 1.2.4 is also to be submitted for consideration.

1.2.3 General description detailing the extent of the machinery or engineering system, the shipboard services it is to provide, its operating principles, and its functionality and capability when operating in the environment to which it is likely to be exposed under both normal and foreseeable abnormal conditions. The general description is to be supported by the following information as applicable:

(a) System block diagram.
(b) Piping and instrumentation diagrams.
(c) Description of operating modes, including:
Start-up, shut-down, automatic, reversionary, manual and emergency.
(d) Description of safety related arrangements, including:
Safeguards, automatic safety systems and interfaces with ships safety systems.
(e) Description of connections to other shipboard machinery, equipment and systems, including:
Electrical, mechanical, fluids and automation.
(f) Plans of physical arrangements, including:
Location, operational access and maintenance access.
(g) Operating manuals, including:
Instructions for start-up, operation, shut-down, instructions for maintenance, instructions for adjustments to the performance and functionality and details of risk mitigation arrangements.
(h) Maintenance manuals, including:
Instructions for routine maintenance, repair following failure, disposal of components and recommended spares inventory.

1.2.4 Project process documentation including:

(a) Project Management Plan, *see* 1.3;
(b) Requirements Definition Document, *see* 1.4;
(c) Quality Assurance Plan, *see* 1.5;
(d) Design Definition Document, *see* 1.6;
(e) Risk Management Plan, *see* 1.7;
(f) Configuration Management Plan, *see* 1.8;
(g) Verification Plan, *see* 1.7;
(h) Integration Plan, *see* 1.10;
(j) Validation Plan (certification and survey), *see* 1.11.

1.3 Project management

1.3.1 A project management procedure is to be established in order to define and manage the key project processes. The project processes are to include the processes described in 1.4 to 1.11.

1.3.2 For the entire project, and each of the processes within the project, the project management procedure is to define the following:

(a) Activities to be carried out.
(b) Required inputs and outputs.
(c) Roles of key personnel.
(d) Responsibilities of key personnel.
(e) Competence of key personnel.
(f) Schedules for the activities.

1.4 Requirements definition

1.4.1 A requirements definition procedure is to be established in order to define the functional behaviour and performance of the machinery or engineering system required by individual stakeholders, in the environments to which the machinery or engineering system is likely to be exposed under both normal and foreseeable emergency conditions.

1.4.2 The procedure is to take account of requirements resulting from key stakeholders, including:
(a) Ship's owner.
(b) Ship's operator.
(c) Ship's crew.
(d) Shipyard.
(e) Systems integrator.
(f) Designers.
(g) Maintenance personnel.
(h) Surveyors.
(j) Manufacturers and suppliers.
(k) Naval Authority.
(l) LR.

1.4.3 The procedure is to take account of requirements resulting from the following influences:
(a) Operations that the ship is intended to perform during trials, at sea, while docking and training exercises, including those related to mission specific activities and degraded and reversionary modes of operation.
(b) Ship conditions during normal operations and conditions arising from accidents or reasonable foreseeable failures or misuse of ship equipment or systems.
(c) The environmental conditions that the equipment or systems will experience due to their location within the ship and due to the geographical location of the ship.
(d) The requirements of applicable legislation, naval, national and International Standards and classification rules, codes of practice and other instruments agreed by the key stakeholders.
(e) The number, availability, competence and overall capability of personnel involved with the use, maintenance, assessment and supervision of the system during ship operations.
(f) Design constraints identified through consideration of the lifecycle of the ship.

1.4.4 The procedure is to specify the functional behaviour and performance requirements and is to identify the source of the requirements.

1.5 Quality assurance

1.5.1 A quality assurance procedure is to be established in order to ensure that the quality of the machinery or engineering system is in accordance with a defined quality management system.

1.5.2 The procedure is to define the specific quality controls to be applied during the project in order to satisfy the requirements of the quality management system.

1.5.3 The quality management system is to satisfy the requirements of ISO9001:2000 *Quality management systems – Requirements*, or an equivalent acceptable National Standard.

1.6 Design definition

1.6.1 A design definition procedure is to be established in order to define the requirements for the design of machinery or an engineering system which satisfies stakeholder requirements, quality assurance requirements and complies with basic internationally recognised design requirements for safety and functionality.

1.6.2 The procedure is to ensure that the design of the machinery or engineering system satisfies:
(a) Statutory legislation.
(b) LR's requirements.
(c) International Standards and codes of practice where relevant.

1.6.3 The procedure is to take account of stakeholder requirements, *see* 1.4.

1.6.4 The procedure is to take account of quality assurance requirements, *see* 1.7.

1.6.5 The procedure is to ensure that the requirements for the design of major components and subsystems of the machinery or engineering system can be verified before and after integration.

1.6.6 The procedure is to specify the design requirements and is to identify the source of the requirements.

1.6.7 Any deviations from stakeholder requirements are to be identified, justified and accepted by the originating stakeholder.

1.7 Risk management

1.7.1 A risk management procedure is to be established in order to ensure that any risks stemming from the introduction of the machinery or engineering system are addressed, in particular risks affecting:
(a) The structural strength and integrity of the ship's hull.
(b) The safety of shipboard machinery and engineering systems.
(c) The safety of shipboard personnel.
(d) The reliability of essential and emergency machinery and engineering systems.
(e) The environment.

1.7.2 The procedure is to consider the hazards associated with installation, operation, maintenance and disposal both with the machinery or engineering system functioning correctly and following any reasonably foreseeable failure.

1.7.3 The procedure is to take account of stakeholder requirements, *see* 1.4.

1.7.4 The procedure is to take account of design requirements, *see* 1.6.

1.7.5 The procedure is to ensure that hazards are identified using acceptable and recognised hazard identification techniques, and that the effects of the following influences are considered:
(a) Operations that the ship is intended to perform during trials, in service, while docking and in harbour, including those related to mission specific activities and degraded and reversionary modes of operation.
(b) Ship conditions during normal operations and abnormal conditions arising from reasonably foreseeable failures or misuse of ship equipment or systems.
(c) Configurations and modes of operation provided for the intended control of machinery and engineering systems.
(d) The environmental conditions that the equipment or systems will experience due to their location within the ship and due to the geographical location in which the ship operates.
(e) The reliance and effects on the operation of engineering systems and machinery of the provision and availability of supplies and services and user interaction, including assessment of interdependencies.
(f) The environmental impact of the ship throughout its life-cycle.

1.7.6 The procedure is to ensure that risks are analysed using acceptable and recognised risk analysis techniques and that the following consequences are considered:
(a) Loss of function.
(b) Loss of services essential to the safety of the ship, services essential to the safety of shipboard personnel and services essential to the protection of the environment.
(c) Damage to components.
(d) Damage caused by fire, explosion, electric shock, harmful releases and hazardous releases.

1.7.7 The procedure is to ensure that risks are eliminated wherever possible. Risks which cannot be eliminated are to be mitigated as necessary.

1.7.8 Details of risks, and the means by which they are mitigated, are to be included in the operating manual, *see* 1.2.3.

1.8 Configuration management

1.8.1 A configuration management procedure is to be established in order to ensure traceability of the configuration of the machinery or engineering system, its subsystems and its components.

1.8.2 The procedure is to identify items essential for the safety or operation of the machinery or engineering system, and which could foreseeably be changed during the life time of the machinery or engineering system, including:
(a) Documentation.
(b) Software.
(c) Sensors.
(d) Actuators.
(e) Instrumentation modules, boards and cards.
(f) Valves.
(g) Pumps.

1.8.3 The procedure is to take account of the design requirements, *see* 1.6.

1.8.4 The procedure is to include items used to mitigate risks, *see* 1.7.

1.8.5 The procedure is to ensure that any changes to configuration control items are:
(a) Identified.
(b) Recorded.
(c) Evaluated.
(d) Approved.
(e) Incorporated.
(f) Verified.

1.9 Verification

1.9.1 A verification procedure is to be established in order to ensure that subsystems and major components of the machinery or engineering system satisfy their design requirements.

1.9.2 The procedure is to verify design requirements, *see* 1.6.

1.9.3 The procedure is to identify the requirements to be verified, the means by which they are to be verified, and the points in the project at which verification is to be carried out.

1.9.4 The procedure is to be based on one or a combination of the following activities as appropriate:
(a) Design review.
(b) Product inspection.
(c) Process audit.
(d) Product testing.

1.10 Integration

1.10.1 An integration procedure is to be established in order to ensure that the machinery or engineering system is assembled in a sequence which allows verification of individual subsystems and major components following integration in advance of validating the entire machinery or engineering system.

1.10.2 The procedure is to take account of the verification requirements, *see* 1.9.

1.10.3 The procedure is to identify the subsystems and major components, the sequence in which they are to be integrated, the points in the project at which integration is to be carried out, and the points in the project at which verification is to be carried out.

1.11 Validation (certification and survey)

1.11.1 A validation procedure is to be established in order to ensure the functional behaviour and performance of the machinery or engineering system meets with its functional and performance requirements.

1.11.2 The procedure is to validate stakeholder requirements, *see* 1.4.

1.11.3 The procedure is to validate arrangements required to mitigate risks, *see* 1.7.

1.11.4 The procedure is to validate the traceability of the configuration control items, *see* 1.8.

1.11.5 The procedure is to identify the requirements to be validated, the means by which they are be validated and the points in the project at which validation is to be carried out, including:
(a) Factory acceptance testing.
(b) Integration testing.
(c) Commissioning.
(d) Sea trials.
(e) Survey.

Volume 2, Part 2, Chapter 1
Diesel Engines

Effective date 1 January 2010

■ *Section 2* Particulars to be submitted

2.1 Plans and information

2.1.1 At least three copies of the following plans are to be submitted:
- Crankshaft assembly plan (for each crank-throw).
- Crankshaft details plan (for each crank-throw).
- Thrust shaft or intermediate shaft (if integral with engine).
- Output shaft coupling bolts.
- Type and arrangement of crankcase explosion relief valves.
- Details of the securing and collision arrangements (*see also* Pt 1, ~~Ch 2~~ Ch 2,3.3.6 and 5.3 to 5.6).
- Schematic oil fuel system, including controls and safety devices.
- High pressure parts for fuel oil injection system with specification of pressures, pipe dimensions and materials.
- Lubricating oil system.
- Starting air system.
- Cooling water system.
- Control engineering aspects in accordance with Part 9.
- Shielding of high pressure fuel pipes.
- Longitudinal and transverse cross-section.
- Cast bedplate, thrust bearing bedplate, crankcase and frames.
- Cylinder head assembly.
- Cylinder liner.
- Piston assembly.
- Tie rod.
- Connecting rod, piston rod, and crosshead assemblies.
- Camshaft drive and camshaft general arrangement.
- Shielding and insulation of exhaust pipes.
- Details of turbochargers.
- Vibration dampers/detuners and moment compensators.
- Cross-sectional plans of the assembled turbo-charger with main dimensions.
- Fully dimensioned plans of the rotor.
- Material particulars with details of welding and surface treatments.
- Turbo-charger operating and test data.
- Manufacturer's Turbo-charger burst test assessment.
- For new engine types that have not been approved by LR, the proposed type test programme.
- The type test report on completion of type testing for a new engine type. For mass produced engines a separate report is to be submitted for each engine requiring approval, *see* 11.5.
- The specification for a mass produced engine including manufacturing processes and quality control procedures, *see* 11.1.4 and 11.2.3.
- Schematic layouts showing details and arrangements of oil mist detection/monitoring and alarm systems.

■ *Section 5* Construction and welded structures

5.3 Materials and construction

5.3.3 Plates and weld preparations are to be accurately machined or flame-cut to shape. Flame-cut surfaces are to be cleaned by machining or grinding; if the flame-cut surfaces are smooth, wire brushing may be accepted.

5.3.4 Before welding is commenced the component parts of bedplates and framework are to be accurately fitted and aligned.

5.3.5 The welding is to be carried out in positions free from draughts and is to be downhand (flat) wherever practicable. Welding consumables are to be suitable for the materials being joined. Preheating is to be adopted when heavy plates or sections are welded. The finished welds are to have an even surface and are to be free from undercutting.

5.3.6 Welds attaching bearing housings to the transverse girders are to have a smooth contour and, if necessary, are to be made smooth by grinding.

5.3.7 Omission of post-weld heat treatment of bedplates and their sub-assemblies will be considered on application by the engine builder with supporting evidence in accordance with Ch 13,8.4 of the Rules for Materials.

5.4 Post-weld heat treatment

5.4.1 Bedplates are to be given a stress relieving heat treatment except engine types where the bedplate as a whole is not subjected to direct loading from the cylinder pressure. For these types, only the transverse girder assemblies need be stress relieved.

5.4.2 Stress relieving is to be carried out by heating the welded structure uniformly and slowly to a temperature between 580°C and 620°C, holding that temperature for not less than one hour per 25 mm of maximum plate thickness and thereafter allowing the structure to cool slowly in the furnace.

5.5 Inspection

5.5.1 Welded engine structures are to be examined during fabrication, special attention being given to the fit of component parts of major joints prior to welding.

5.5.2 On completion of welding and stress relief heat treatment, all welds are to be examined.

5.5.3 Welds in transverse girder assemblies are to be crack detected by an approved method to the satisfaction of the Surveyors. Other joints are to be similarly tested if required by the Surveyors.

■ *Section 6*
Safety arrangements on engines

6.2 Crankcase relief valves

6.2.3 Each valve is to be fitted with a flame arrester that permits flow for crankcase pressure relief and prevents the passage of flame following a crankcase explosion. The valves are to be type tested in a configuration that represents the installation arrangements that will be used on an engine and in accordance with Section 13. ~~a standard acceptable to LR~~. The valves are to be positioned on engines to minimise the possibility of danger and damage arising from emission of the crankcase atmosphere. Where shielding from the emissions is fitted to a valve, the valve is to be tested to demonstrate that the shielding does not adversely affect the operational effectiveness of the valve.

■ *Section 7*
Starting arrangements

7.6 Starting of the emergency source of power

7.6.4 Electronically controlled emergency engines are to comply with the additional requirements of 15.5.

~~*7.6.4*~~ *7.6.5* When automatic starting is not required by the Rules and where it can be demonstrated as being effective, hand (manual) starting is permissible, such as manual cranking, inertial starters, manual hydraulic accumulators, powder charge cartridges.

~~*7.6.5*~~ *7.6.6* When hand (manual) starting is not practicable, the provisions of 7.6.2 and 7.6.3 are to be complied with except that starting may be manually initiated.

~~*7.6.6*~~ *7.6.7* Engine starting batteries are to be used only for the purposes of starting the engines and for the engines' own monitoring arrangements.

■ *Section 15*
Electronically controlled engines

15.1 Scope

15.1.1 The requirements of this Section are applicable to engines for propulsion, auxiliary ~~and~~ or emergency, *see* 15.5, power purposes with ~~software based electronic control of~~ programmable electronic systems implemented and used to control fuel injection timing and duration, and which may also control combustion air ~~and~~ or exhaust systems. The requirements of this Section also apply to programmable electronic systems used to control other functions (e.g. starting and control air, cylinder lubrication, etc.) where essential for the operation of the engine.

15.1.2 These engines may be of the slow, medium or high speed type. They generally have no direct camshaft ~~to drive~~ driven fuel, air ~~and~~ or exhaust systems but have common rail fuel/hydraulic arrangements and may have hydraulic actuating systems for the functioning of the ~~fuel,~~ air ~~and~~ or exhaust systems.

15.1.5 During the life of the engine details of any proposed changes to hardware, software, control and monitoring systems are to be submitted ~~and approved by~~ to LR for approval.

15.2 Plans and particulars

15.2.1 In addition to the plans and particulars required by Ch 1,2 the following information is to be submitted:

(a) A general overview of the operating principles supported by schematics explaining the functionality of individual systems and sub-systems. The information is to relate to the engine capability and functionality under defined operating and emergency conditions such as recovery from a failure or malfunction, with particular reference to the functioning of electronic control systems and any sub-systems. Also, the information is to indicate if the engine has different modes of operation, such as to limit exhaust gas emissions and/or to run under an economic fuel consumption mode or any other mode that can be controlled by electronic control systems.

(b) Details of hydraulic systems for actuation of sub-systems (fuel injection, air inlet ~~and~~ or exhaust), to include details of the design/construction of pipes, pumps, valves, accumulators and the control of valves/pumps. Details of pump drive arrangements are also to be included.

(c) Failure Modes and Effects Analysis (FMEA) of the mechanical, pressure containing and electrical systems and arrangements that support the operation of the engine. The analysis is to demonstrate that suitable risk mitigation has been achieved so that a system will tolerate a single failure in equipment or loss of an associated sub-system such that operation of the engine will not be lost or degraded beyond acceptable performance criteria of the engine.

(d) A schedule of testing and trials to demonstrate that the engine is capable of operating as described in the design statement and any testing required to verify the conclusions of the FMEA. The schedule is to include integration tests to verify that the response of the complete mechanical, hydraulic and electronic system is as predicted for all intended operational modes. The scope of these tests is to be agreed with LR for selected cases based on the FMEA required in (c).

(e) Operating manuals that describe particulars of each system and together with operating and maintenance instructions, to include reference to the arrangements for making modifications and changes to electronic control systems and for the functioning of sub-systems.

(f) Quality plan for sourcing, design, installation and testing of all components used in the oil fuel and hydraulic oil systems installed with the engine for engine operation.

(g) Fatigue analysis for all high pressure oil fuel and hydraulic oil piping arrangements required for engine operation where failure of the pipe or its connection or a component would be the cause of engine unavailability. The analysis is to concentrate on high pressure components and sub-systems and recognise the pressures and fluctuating stresses that the pipe system may be subject to in normal service.

(h) Schedule of testing at engine builders, pre-sea trial commissioning and sea trials. The test schedules are to identify all modes of engine operation and the sea trials are to include typical port manoeuvres under all intended engine operating modes.

(j) Evidence of type testing of the engine with electronic controls or a proposed test plan at the engine builders with the electronic controls functioning to verify the functionality and behaviour under normal operating and fault conditions of the electronic control system.

(k) For emergency engines, evidence and details showing compliance with 15.5.

15.4 Electronic control systems

15.4.2 Programmable electronic equipment self-monitoring capabilities, *see* Pt 9, Ch 1,2.10.7, are to include, at least:

- watchdog facilities to monitor for system lock-ups (program hangs);
- means to detect whether starting, shut-down and control command data communication links are operational; and
- power supply failure including as a result of internal fuse or protective device operation.

15.5 Emergency engines

15.5.1 Electronically controlled engines will only be accepted for use as emergency engines when the additional requirements of this sub-Section are satisfied.

15.5.2 Evidence is to be submitted confirming that the Naval Authority accepts the proposed use of an electronically controlled engine for emergency power purposes.

15.5.3 Electrically powered control equipment required for engine starting or operation is to be served by not less than two individual power supplies, one fed from a main switchboard circuit and one from an emergency switchboard circuit provided in accordance with 15.5.4 and 15.5.5.

15.5.4 Each power supply is to be provided with an Uninterruptible Power System (UPS) in accordance with Pt 10, Ch 1,9.3 capable of supplying the starting arrangements for three successive starts over a period of at least 30 minutes. A manual supply changeover switch is to be provided.

15.5.5 The power supplies are not to pass through a common switchboard or section board and are not to use common feeders, protective devices, control circuits, control gear assemblies or battery chargers, so that any single fault will not cause the loss of both supplies. Where adequate circuit protection and stored battery and charging capacity exists, the engine starting batteries may be used to provide one supply.

15.5.6 Where the proposed arrangement of engine electronic control systems do not incorporate redundancy to satisfy the requirements of 15.6.1, evidence is to be submitted that demonstrates the arrangements have been assessed and found to comply with IEC 61508, functional safety of electrical/electronic/programmable electronic systems, or a relevant alternative standard. The submissions are to include proposals for LR to verify compliance (reviews, Surveys, trials, etc.) with the applicable standard(s).

Existing sub-Section 15.5 *is to be renumbered* 15.6.

Volume 2, Part 2, Chapter 2
Gas Turbines

Effective date 1 January 2010

■ *Section 2*
Particulars to be submitted

2.1 Plans and information

2.1.2 To assess compliance with the design requirements of the Rules and for inspection, installation and record purposes, the following plans are to be submitted for consideration:

- (a) Casing construction arrangement.
- (b) Arrangements of combustion chambers, intercoolers and heat exchangers.
- (c) Compressor and gas generator rotating components.
- (d) Control engineering systems, *see* Pt 9, Ch 1.
- (e) Cooling and sealing air arrangements for compressor and gas generator components: Schematic only.
- (f) Cooling water system: Schematic only.
- (g) Fuel system schematic.
- (h) Gas turbine unit acoustic enclosure, if applicable, including ventilation and drainage systems: Schematic only.
- (j) Inlet and exhaust ducting arrangement.
- (k) Lubricating oil systems: Schematic only.
- (l) Nozzles, blades and blade attachments.
- ~~Oil fuel systems: Schematic only.~~
- (m) Power turbine components.
- (n) Rotors, bearings and couplings.
- (o) Section assembly.
- (p) Securing arrangement, where applicable, including details of resilient mounts, *see also* Pt 1, Ch 2,3.3.6.
- (q) Starting system: Schematic only.
- ~~Air bleed system: Schematic only.~~
- (r) Details of anti stall and surge systems or devices.
- (s) Details of materials of all load bearing and torque transmitting components and pressure retaining parts.
- (t) Details of materials for rotors and discs are to be submitted for approval.

■ *Section 4*
Design and construction

4.4 Intake and exhaust ducts

4.4.9 The exhaust system is to be arranged so that hot exhaust gases are directed to avoid impingement on equipment and away from areas to which personnel have access, either on board or in the vicinity of where the craft is berthed.

4.11 Anti stall/surge systems

4.11.1 Air bleed (blow off) valves and/or variable geometry mechanisms are to be fitted as required to maintain compressor surge margins throughout the operating range. Any open ended air bleed arrangements are to be led to the uptake or atmosphere and not into the machinery space, the back pressure imposed by the ducting is to be in accordance with the turbine manufacturer's recommendations.

■ *Section 5*
Piping systems

~~5.5 Air bleed systems~~

~~*5.5.1* Where specified in the operational requirements, provision is to be made for bleeding air from the compressor section in accordance with the design statement. Any open ended air bleed arrangements are to be led to the uptake or atmosphere and not into the machinery space.~~

■ *Section 7*
Control, alarm and safety systems

7.9 Automatic and remote controls

(*Part only shown*)

Table 2.7.1 Gas turbine machinery: Alarms and shutdowns

Item	Alarm	Note
Scavenge oil temperature	~~Low~~ High	~~Automatic shutdown~~ —
Scavenge oil pressure	~~High~~ Low	— Automatic shutdown
Bearing temperature	High	—

Volume 2, Part 7, Chapter 1
Piping Design Requirements

Effective date 1 January 2010

■ *Section 5*
Pipe connections

5.8 Welded sleeve joints

5.8.5 The thickness of the sleeve is to satisfy the requirements of 6.1.3 and Table 1.6.4 but is to be not less than 1,42 times the nominal thickness of the pipe in order to satisfy the throat thickness requirement in 5.8.6. The radial clearance between the outside diameter of the pipe and the internal diameter of the sleeve is not to exceed 1mm for pipes up to a nominal diameter of 50 mm, 2 mm on diameters up to 200 mm nominal size and 3 mm for larger size pipes. The pipe ends are to be separated by a clearance of approximately 2 mm at the centre of the sleeve.

■ *Section 11*
Plastic piping and components

11.4 Fire performance criteria

11.4.4 The Naval Authority may extend the requirements of 11.4.3 to apply to on equipment piping in machinery spaces. *See also* 11.1.8.

~~*11.4.4*~~ *11.4.5* Where a fire protective coating of pipes and fittings is necessary for achieving the fire endurance standards required, the coating is to be resistant to products likely to come into contact with the piping and be suitable for the intended application.

■ *Section 13*
Flexible hoses

13.2 Applications

13.2.3 Rubber hoses, with single, ~~or~~ double or more closely woven integral wire braid or other suitable material reinforcement, or convoluted metal pipes with wire braid protection, may be used in bilge, ballast, compressed air, fresh water, sea-water, fuel oil, lubricating oil, Class III steam, hydraulic and thermal oil systems. Flexible hoses of plastics materials for the same purposes, such as Teflon or Nylon, which are unable to be reinforced by incorporating closely woven integral wire braid are to have suitable material reinforcement as far as practicable. Where rubber or plastics hoses are used for ~~oil~~ fuel oil supply to burners, the hoses are to have external wire braid protection in addition to the integral wire braid. Flexible hoses for use in steam systems are to be of metallic construction.

Volume 2, Part 7, Chapter 4
Aircraft/Helicopter/Vehicle Fuel Piping and Arrangements

Effective date 1 January 2010

■ *Section 1*
General requirements

1.2 Plans and particulars

1.2.3 **Operating manuals**. Operating manuals are to be ~~submitted to Lloyd's Register (hereinafter referred to as 'LR') for information and~~ provided on board and submitted for information where requested by LR. The manuals are to include the following information:

(a) Particulars and description of systems and arrangements for bunkering, fuelling and defuelling aircraft/ helicopters and vehicles.

(b) Operating instructions for the systems.

Volume 2, Part 7, Chapter 5
Ship Type Piping Systems

Effective date 1 January 2010

■ *Section 1*
General requirements

1.3 Plans and information

1.3.3 **Systems**. Plans in diagrammatic form showing piping arrangements, control systems and safeguards and electrical systems for each Ship Type piping system covered by this Chapter. The capacities of pumps and compressors are to be included. ~~Capacity~~ For chilled water systems, heat load calculations or heat balance sheets and capacity tables with condensing temperatures covering the operating range of the refrigeration compressors are also to be included. The Tables are to be representative of the compressors operating at the design revolutions per minute with the nominated refrigerant.

1.3.6 **Testing and trials procedures**. A schedule of testing and trials to demonstrate that systems are capable of operating as described in Section 3. Testing and trials procedures are to be comply with 6.3.1. In addition, any testing programme that may be necessary to prove the conclusions of the FMEA, *see* 6.3.2.

1.3.7 **Operating Manuals**. Operating Manuals are to be ~~submitted for information and~~ provided on board and submitted for information where requested by LR. The Manuals are to include the following information:

(a) Particulars and a description of each system.
(b) Operating instructions for all systems.
(c) Procedures for dealing with the situations identified in the FMEA report.

■ *Section 11*
Hydraulic power actuating systems

11.1 General

11.1.2 The arrangements for storage, distribution and utilisation of hydraulic and other flammable oils employed under pressure in power transmission systems, control and actuating systems and heating systems in locations where means of ignition are present are to comply with the provisions of Ch 3,~~2.8.4, 2.8.5, 2.8.6~~ 2.9.3, 2.9.4, 2.9.5, 4.2, 4.3, 4.5, 4.11 and 4.16 where applicable.

Volume 2, Part 9, Chapter 1
Control Engineering Systems

Effective date 1 January 2010

■ *Section 1*
General engineering systems

1.2 Plans and information

1.2.2 **General**. Description of operation (with explanatory diagrams), schematic diagrams of circuits, and lists of monitored parameters with relevant setpoints:

- Controllable pitch propellers.
- Electric generating plant.
- Incinerators.
- Miscellaneous machinery or equipment (where control, alarm and safety systems are specified in other Sections of the Rules).
- Oil fuel transfer and storage systems.
- Propulsion machinery including essential auxiliaries.
- Steam raising plant (boilers and their ancillary equipment).
- Steering systems.
- Thermal fluid heaters.
- Thrust units.
- Valve position indicating systems.
- Waste-heat systems.
- Waterjets for propulsion purposes.
- Fixed water-based local application fire-fighting systems, *see* 2.9.

■ *Section 2*
Essential features for control, alarm and safety systems

2.4 Safety systems, general requirements

2.4.1 Where safety systems are provided, the requirements of 2.4.2 to 2.4.12 are to be satisfied. The requirements of this sub-Section apply, where relevant, to the safety systems installed on the equipment defined in 1.2.3, including those provided in addition to those safeguards required by Section 3 or other Sections of the Rules.

2.9 Fixed water-based local application fire-fighting systems

2.9.1 Where fixed water-based local application fire-fighting systems are installed in machinery spaces of category A in addition to the main fixed fire-extinguishing system to protect the fire hazard portions of machinery, the arrangements are to be in accordance with this sub-Section.

2.9.2 Systems are to be available for immediate use and arranged for manual activation from inside and outside the protected space. *See also* Pt 10, Ch 1,16.3.4.

2.9.3 The activation of a system is not to result in loss of electrical power or reduction of the manoeuvrability of the ship and is not to require confirmation of space evacuation or sealing, *see also* Pt 1, Ch 2,3.3.15 and Pt 10, Ch 1,16.3.12.

2.9.4 Where the Navy or Naval Authority requires automatic shut-down and/or isolation of protected machinery and equipment in adjacent areas in the event of system activation, evidence is to be submitted to demonstrate compliance with 2.9.3. This submission is to address:

- the applicable Navy or Naval Authority requirements;
- the failure effects of automatic shutdown and/or isolation measures on the machinery, equipment and the complete installation;
- the measures provided to prevent the loss of electrical power;
- the measures provided to prevent a reduction of the manoeuvrability of the ship; and
- the measures provided to ensure continued operation of the activated system.

The submission is to detail:

- permitted operating configurations while propulsion and steering machinery is operating;
- temporary interruptions in power supply while in port allowed by the Navy or Naval Authority; and
- power restoration measures following automatic shut-down and/or isolation of machinery or equipment.

See also Pt 10, Ch 1,16.3.5.

2.9.5 System zones and protected areas are to be arranged to allow essential services to be provided by machinery and/or equipment located outside areas affected by direct spray or extended water in the event of a system activation, where the machinery and/or equipment is duplicated or otherwise replicated to provide redundancy.

2.9.6 A control panel is to be provided for managing actions such as opening of valves, starting of pumps and sounding of alarms and processing information from detectors. This panel is to be independent of the fire detection control unit required by 2.8.

2.9.7 Alarms are to be initiated upon activation of a system and are to indicate the specific zone activated at the control panel. Alarms are to be provided in each protected space, at an attended machinery control station and in the wheelhouse. The audible alarm is to be distinguishable from other safety system alarms.

2.9.8 A failure in a manual system activation switch circuit is not to prevent system activation using other installed manual system activation switches or, where installed, automatic activation. The means of activation are to be provided with self-monitoring facilities that will activate an alarm at an attended control station in the event of failure detection.

2.9.9 Systems installed in periodically unattended machinery spaces are to, additionally, be capable of automatic release and the arrangements are to be in accordance with 2.9.10 to 2.9.13.

2.9.10 A minimum of two fire detectors are to be provided for each protected area. One is to be a flame detector and the other is to be a smoke or heat detector, as considered appropriate to the nature of the risk and ambient conditions. The system is to be activated upon detection by two of the detectors. A fault in one detector is to initiate an alarm at an attended control station and is not to inhibit activation of the system under the control of the other detector or manually. Detector faults are not to cause activation of the system.

2.9.11 The fire detectors are to be arranged (located, oriented, guarded, etc.) to ensure that a fire in one protected area will not result in the inadvertent automatic activation of a system for another protected area. Guards or barriers provided to comply with this requirement are not to reduce the ability to detect a fire in the protected area.

2.9.12 A fire detection alarm system panel in accordance with 2.8 may be used for receiving fire detection signals. Separate loops are not required provided that the address of the initiating device can be identified at the control panel. The received signals are then to be sent to the control panel required by 2.9.6 for processing and action.

2.9.13 The system's fire detection systems and control units are to meet the performance criteria of SOLAS Ch II/C, Reg. 7 and are to be Type Approved in accordance with *Test Specification Number 1* given in LR's *Type Approval System* for an environmental category appropriate for the locations in which they are intended to operate.

Existing sub-Sections 2.9 *to* 2.12 *are to be renumbered* 2.10 *to* 2.13.

~~2.11~~ 2.12 Programmable electronic systems – Additional requirements for Mobility category and safety critical systems

~~*2.11.3*~~ *2.12.3* Items of programmable electronic equipment used to implement control, alarm and safety functions are to ~~be certified in accordance with~~ satisfy the requirements of LR's Type Approval System, *Test Specification Number 1 (2002)*.

Volume 2, Part 10, Chapter 1
Electrical Engineering

Effective date 1 January 2010

■ *Section 1*
General requirements

1.2 Plans

1.2.4 Calculations of short circuit currents at main and emergency switchboards and section boards including those fed from transformers, details of circuit breaker and fuse operating times, settings and discrimination curves showing compliance with 6.1 and 10.6.2.

1.2.8 Details of electrically-operated fire, ship, crew and embarked personnel emergency safety systems which are to include typical single line diagrams and arrangements, showing main vertical and, where applicable, horizontal fire zones and the location of equipment and cable, including identification of relevant areas of high fire risk, to be employed for:

(a) emergency lighting (other than where accumulator emergency lanterns are to be installed);
(b) accommodation fire detection, alarm and extinction systems;
(c) fixed water-based local application fire-fighting systems;
~~(c)~~ (d) crew and embarked personnel address system;
~~(d)~~ (e) general alarm;
~~(e)~~ (f) watertight doors, bow, stern and shell doors and other electrically operated closing appliances; and
~~(f)~~ (g) low location lighting.

NOTE
A general arrangement plan of the complete ship showing the main vertical fire zones and the location of equipment and cable routes, including identification of relevant areas of high fire risk, for the above systems, is to be made available for the use of the Surveyor on board.

1.2.9 Evidence of the suitability of electrical and electronic equipment for use in protected areas and adjacent areas, as required by 16.3.9 and 16.3.10, including a schedule of electrical and electronic equipment located in protected areas and adjacent areas and general arrangement plans showing the coverage of the protected areas and adjacent areas.

Existing paragraphs 1.2.9 *to* 1.2.20 *are to be renumbered* 1.2.10 *to* 1.2.21.

~~*1.2.13*~~ *1.2.14* ~~Plans~~ General arrangement plans showing the location of propulsion generators, motors, ~~converting equipment~~ transformers, semiconductor converters, dynamic braking equipment, reactors and filters. The information supplied is also to include cable routes to show compliance with 10.8, as applicable.

~~*1.2.14*~~ *1.2.15* ~~For~~ Plans for all cables that pass through atria or equivalent spaces, and for vertical runs in trunks or other restricted space~~s, the~~. The information supplied is to show compliance with ~~10.8.8~~ 10.8.10.

1.3 Surveys

1.3.3 For electric propulsion systems, in addition to the equipment listed in 1.3.2, the following equipment is to be surveyed by the Surveyors during manufacture and testing:

- cables, *see* 10.1.3;
- exciters;
- filters;
- reactors;
- dynamic braking assemblies;
- pre-magnetisation transformers; and
- slip ring assemblies

1.4 Additions or alterations

1.4.4 Proposed modifications to the electrical protection systems are to be developed in accordance with 6.1.4 and plans submitted are also to address the updating of the approved version of the details required by 1.2.3 and 1.2.4.

~~*1.4.4*~~ *1.4.5* When it is proposed to replace permanently installed secondary valve-regulated sealed batteries with vented batteries, details are to be submitted for consideration to ensure continued safety in the presence of the products of electrolysis and evaporation being allowed to escape freely from the cells to the atmosphere. These details are to demonstrate that there will be adequate ventilation in accordance with 11.5.9 and that the location and installation requirements of 11.3 and 11.4 are complied with.

1.4.6 Where it is intended to replace an existing incandescent lamp type navigation light with a light emitting diode type navigation light, details are to be submitted for consideration that demonstrate compliance with 14.5. Light emitting diode type navigation lights failure detection arrangements are to additionally satisfy the requirements of 14.5.4 and 14.5.5.

1.5 Definitions

1.5.12 Protected space is a machinery space where a fixed water-based local application fire-fighting system is installed.

1.5.13 Protected areas are areas within a protected space which are protected by a fixed water-based local application fire-fighting system.

1.5.14 Adjacent areas are those, other than protected areas, exposed to direct spray or other areas where water may extend when a fixed water-based local application fire-fighting system is activated.

1.11 Location and construction

1.11.6 The minimum creepage and clearance distances provided for electrical connections, terminals and similar bare live parts are to be in accordance with a relevant International or National Standard for the equipment or apparatus concerned. In cases where the rated voltage is outside that given in the Standard or where no Standard is available, the minimum creepage and clearance distances provided are to be in accordance with 7.5. Details of alternative proposals including supporting design rationale and demonstration may be submitted for consideration.

Existing paragraphs 1.11.6 *to* 1.11.11 *are to be renumbered* 1.11.7 *to* 1.11.12.

1.12 Earthing of non-current carrying parts

1.12.3 Extraneous-conductive parts (i.e. parts not forming part of the electrical installation and liable to introduce an electric potential) which are connected to the ship's hull by permanent and reliable metal-to-metal joints of negligible impedance that will not be affected by vibration and shock as arise in normal practice need not be bonded by separate earthing conductors.

Existing paragraphs 1.12.3 *to* 1.12.9 *are to be renumbered* 1.12.4 *to* 1.12.10.

1.18 Programmable electronic systems

1.18.1 Where programmable electronic systems are implemented and used to control the electrical installation, or to provide safety functions in accordance with the requirements of this Chapter (e.g. electric propulsion, circuit-breaker settings, switchgear and control gear controllers, etc.), the arrangements are to satisfy the applicable requirements of Pt 9, Ch 1,2.9 to 2.12.

1.18.2 Where 1.18.1 applies, proposed modifications to software and acceptance testing and trials are to be in accordance with Pt 9, Ch 1,1.4 and Section 6 as applicable.

■ *Section 3*
Emergency and alternative sources of electrical power

3.1 General

3.1.3 Where the main sources of electrical power are located in two or more compartments that are not contiguous with each other, and where each source has its own independent self-contained systems, including power distribution and control systems, such that a fire or casualty in any one of the compartments will not affect the power distribution from the other(s), or to the services required by 3.2.7, the requirement of this Section will be satisfied without an additional emergency source of electrical power and its associated transitional source of power, provided that:

(a) there is at least one generating set complying with the requirements of 2.2 and of sufficient capacity to meet the requirements of 3.2.7 in at least two non-contiguous compartments; and

(b) the generator sets referred to in 3.1.3(a) and their self-contained systems are installed such that one of them remains operable and readily accessible after damage or flooding in any one compartment; and

(c) the generator sets referred to in 3.1.3(a) are capable of being automatically started on loss of the power supplied by the other main source(s) of electrical power and supplying the services required by 3.2.7 as quickly as is safe and practicable subject to a maximum of 45 seconds or provided with a transitional source of emergency electrical power as specified in 3.2.9; and

~~(c)~~ (d) the number and arrangements of generators is to allow for maintenance at sea of any one generator without affecting the ability to supply electrical power to the services in 3.2.7 from either of at least two compartments; and

~~(d)~~ (e) the requirements of this Chapter applicable to the emergency source or any associated equipment are to be applied to the main source complying with 2.2, or any associated equipment.

3.2 Emergency source of electrical power

(*Part only shown*)

3.2.8 The emergency source of electrical power may be either a generator or an accumulator battery, which is to comply with the following:

(a) Where the emergency source of electrical power is a generator it is to be:

(i) driven by a suitable prime mover with an independent supply of fuel, having a flashpoint (closed-cup test) of not less than 43ºC;

(ii) started automatically upon failure of the main source of electrical power supply unless a transitional source of emergency electrical power in accordance with ~~3.2.7~~ 3.2.9 is provided; where the emergency generator is automatically started, it is to be automatically connected to the emergency switchboard; those services referred to in 3.2.7 are to be connected automatically to the emergency generator; and

(iii) provided with a transitional source of emergency electrical power as specified in ~~3.2.7~~ 3.2.9 unless an emergency generator is provided capable both of supplying the services mentioned in that paragraph and of being automatically started and supplying the required load as quickly as is safe and practicable subject to a maximum of 45 seconds.

■ *Section 6*
System design – Protection

6.1 General

6.1.4 Protection systems are to be developed using a systematic design procedure incorporating verification and validation methods to ensure successful implementation of the requirements above. Details of the procedures used are to be submitted when requested. An approved copy of the details required by 1.2.3 and 1.2.4 is to be retained on board and made available to the LR Surveyor on request.

■ *Section 7*
Switchgear and control gear assemblies

7.3 Circuit-breakers

7.3.5 Where the means of setting adjustable protection characteristics are not durably marked and locked in position and cannot be visually inspected (e.g. electronic storage), the setting of characteristics is to be recorded in accordance with an acceptable quality management system with a copy of the records included in the details retained on board, *see* 6.1.4.

■ *Section 8*
Rotating machines

8.4 Generator control

8.4.5 Generators and their voltage regulation systems are to be capable of maintaining, without damage, under steady state short circuit conditions a current of at least three times the full load rated current for a duration of at least two seconds or where precise data is available for the duration of any time delay which may be provided by a tripping device for discrimination purposes. The generator terminal voltage is not to exceed ~~120~~ 130 per cent of the rated voltage when the short circuit is removed.

■ *Section 10*
Electric cables and busbar trunking systems (busways)

10.1 General

10.1.2 Electric cables for fixed wiring are to be designed, manufactured and tested in accordance with the relevant IEC Standard stated in Table 1.10.1 or a relevant standard acceptable to the Naval Authority. On application, LR may be able to assess the acceptability of cables in accordance with specified standards other than the relevant IEC Standards on behalf of the Naval Authority, *see also* 1.1.6.

10.1.3 Surveys of cables for electric propulsion systems surveys during manufacture and testing, *see* 1.3.3, are to assess compliance with the applicable International, National or Naval Standards and the application of an acceptable quality management system.

Existing paragraphs 10.1.3 *to* 10.1.5 *are to be renumbered* 10.1.4 *to* 10.1.6.

10.5 Construction

10.5.5 ~~Electric cables where it is required that their construction~~ Where it is required that the construction of electrical cables includes metallic sheaths, armouring or braids they are to be provided with an overall impervious sheath or other means to protect the metallic elements against corrosion, *see also* 10.8.7 and 10.8.8.

10.5.6 Where cables are installed in an area where contamination by oil is likely to occur, the oversheath is to be of an enhanced oil resistance grade.

Existing paragraphs 10.5.6 *to* 10.5.8 *are to be renumbered* 10.5.7 *to* 10.5.9.

10.8 Installation of electric cables

10.8.7 Cables having an exposed metallic screen, braid or armour are to be installed in such a manner that galvanic corrosion by contact with other metals is prevented. Sufficient measures are also to be taken to prevent damage to exposed galvanised coatings during installation.

10.8.8 Adequate protection is to be provided for cable oversheaths in areas where cables are likely to be exposed to damaging substances under normal circumstances or areas where the spillage or release of harmful substances is likely.

Existing paragraphs 10.8.7 *to* 10.8.19 *are to be renumbered* 10.8.9 *to* 10.8.21.

■ *Section 13*
Electrical equipment for the use in explosive gas atmospheres or in the presence of combustible dusts

13.1 General

13.1.3 ~~For design guidance on electrical systems~~ Electrical installations in magazines~~, refer~~ are to be in accordance with Vol 1, Pt 4, Ch 1,6.8.

■ *Section 14*
Navigation and manoeuvring systems

14.5 Navigation lights

14.5.4 For navigation lights using light emitting diodes (consisting of multiple light sources) means to ensure that the overall luminous intensity of the navigation light is sufficient are to be provided in addition to the alarm to indicate the complete loss of the navigation light illumination required by 14.5.3. For replacement navigation lights, *see* 1.4.5.

14.5.5 To satisfy 14.5.4, an audible and visual alarm is to be activated to notify the bridge Officer of the Watch when the luminous intensity of the light reduces below the level required by the IMO *Convention on the International Regulations for Preventing Collisions at Sea*. Alternative measures to ensure continuing acceptable performance of navigation lights using light emitting diodes may be considered that are in accordance with:

- IMO Res. MSC.253(83), *Performance Standards for Navigation Lights, Navigation Light Controllers and associated Equipment*, and
- EN 14744, *Inland navigation vessels and sea-going vessels – Navigation light*, or a relevant National, International or Naval Standard.

Where alternative measures are proposed that require verification by personnel of the luminous intensity of navigation lights using light emitting diodes, details of the periodic inspection implementation and acceptance by the Naval Authority are to be submitted for consideration.

Existing paragraphs 14.5.4 *and* 14.5.5 *are to be renumbered* 14.5.6 *and* 14.5.7.

■ *Section 16*
Fire safety systems

16.1 Fire detection and alarm systems

16.1.15 Where it is intended that detectors be installed in external locations, in addition to meeting the requirements for an environmental category suitable for open decks, *see* Pt 9, Ch 1,2.8.7, they are also to be tested for sun irradiation and ultraviolet exposure with satisfactory results.

16.3 Fixed water-based local application fire-fighting systems

16.3.1 Where fixed water-based local application fire-fighting system pressure sources are reliant on external power they need only be supplied by the main source of electrical power.

16.3.2 The fire detection, control and alarm systems are to be provided with an emergency source of electrical power required by 3.2 or 3.3 and are also to be connected to the main source of electrical power. Separate feeders, reserved solely for this purpose, with automatic changeover facilities located in, or adjacent to, the main control panel are to be provided.

16.3.3 Failure of any power supply is to operate an audible and visual alarm. *See also* 1.13 and 1.14.

16.3.4 Means to activate a system are to be located at easily accessible positions inside and outside the protected space. Arrangements inside the space are to be situated such that they will not be cut off by a fire in the protected areas and are suitable for activation in the event of escape. Where it is proposed to install local activation means outside of the protected space, details are to be submitted for consideration.

16.3.5 For the electrical safety of electrical and electronic equipment in areas protected by fixed water-based local application fire-fighting systems and adjacent areas where water may extend, the requirements of 16.3.6 to 16.3.10 apply. *See also* Pt 1, Ch 2,3.3.15 and Pt 9, Ch 1,2.9.

16.3.6 As far as is practicable, electrical and electronic equipment is not to be located within protected areas or adjacent areas. The system pump, its electrical motor and the sea valve, if any, may be in a protected space provided that they are outside areas where water or spray may extend.

16.3.7 High voltage equipment and their enclosures are not to be installed in protected areas or adjacent areas. For high voltage generator enclosures which cannot be fully located outside of adjacent areas due to close proximity, a technical justification, including proposed degree of protection ratings that are normally not to be lower than IP54, may be submitted for consideration that demonstrates the overall safety of the installation in the event of system operation.

16.3.8 In addition to the degree of protection requirements of 1.11.1, electrical and electronic equipment enclosures located within protected areas and within adjacent areas are to provide adequate protection in the event of system operation.

16.3.9 To demonstrate compliance with 16.3.8, evidence of the suitability of electrical and electronic equipment for use in protected areas and adjacent areas is to be submitted in accordance with Pt 1, Ch 2,3.3.15 and 5.12.2. The evidence is to demonstrate that additional precautions have been taken, where necessary, in respect of:

(a) satisfying 16.3.6 and 16.3.7;
(b) the damage control and fire-fighting policy of the Navy or Naval Authority, *see* Pt 1, Ch 2,4.1.6;
(c) personnel protection against electric shock; and
(d) cooling airflow, where necessary, for equipment required to operate during system operation.
(e) maintenance requirements for equipment before return to operation following system activation.

Any test evidence submitted is to consider the overall installation, including equipment types, system configuration and nozzles and the potential effects of airflows in the protected space.

16.3.10 The evidence required by 16.3.9 is to demonstrate the safe and effective operation of the overall arrangements in the event of system operation. This evidence is to demonstrate that exposure to system spray and/or water:

- cannot result in loss of essential services (e.g. unintended activation of automatic machinery shut-down);
- cannot result in loss of availability of emergency services;
- will not affect the continued safe and effective operation of electrical and electronic equipment required to operate during the required period of system operation;
- does not present additional electrical or fire hazards; and
- would require only identified readily replaceable components to be repaired or replaced.

The installation of electrical and electronic equipment required to provide essential or emergency services in enclosures with a degree of protection less than IP44 within areas exposed to direct spray is to be acceptable to LR, and evidence of suitability is to be submitted accordingly.

16.3.11 Fixed water-based local application fire-fighting system electrically-driven pumps may be shared with:

- equivalent automatic sprinkler systems;
- equivalent main machinery space fire-fighting systems; or
- local fire-fighting systems for deep-fat cooking equipment;

provided that the shared use is accepted by the Navy or Naval Authority as complying with their applicable regulations and the arrangements comply with the requirements of 16.3.12 to 16.3.14.

16.3.12 Shared electrically-driven sea-water pumps are to be served by not less than two circuits reserved solely for this purpose, one fed from the main source of electrical power and one from the emergency source of electrical power. Such feeders are to be connected to an automatic changeover switch situated near the pumps and the switch is to be normally closed to the feeder from the main source of electrical power. No other switches are permitted in the feeders. The switches on the main and emergency switchboards are to be clearly labelled and normally kept closed.

16.3.13 Failure of a component in the power and control system is not to result in a reduction of the total available pump capacity below that required by any of the areas the system is required to protect. For equivalent automatic sprinkler systems, a failure is not to prevent automatic release capability or reduce overall sprinkler pump capacity by more than 50 per cent.

16.3.14 Where fire-fighting systems share fire-fighting pumps, failure of one system is not to prevent activation of the pumps by any other system.

Existing sub-Sections 16.3 *to* 16.8 *are to be renumbered* 16.4 *to* 16.9.

~~16.5~~ 16.6 Fire safety stops

16.6.6 Exhaust ducts from main laundries are to be fitted with additional remote control arrangements for shutting off the exhaust fans and supply fans from within the space and for operating fire dampers, where fitted, at the lower end of the duct.

~~16.7~~ 16.8 Fire dampers

16.8.3 Fire dampers fitted at the lower end of exhaust ducts from main laundries are to be capable of automatic and remote operation.

Volume 2, Part 11, Chapter 1
Made and Fresh Water Systems

Effective date 1 January 2010

■ *Section 1*
General requirements

1.3 Plans and information

1.3.6 **Operating manuals**. Operating manuals are to be ~~submitted for information and~~ provided on board and submitted for information where requested by LR. The manuals are to include the following information:

(a) Particulars and a description of the systems for the production, storage and distribution of made and fresh water. The particulars are to include system arrangement plans showing each mode of operation of each system.

(b) Operating arrangements for each mode of operation for the equipment and systems installed.

(c) Cleaning arrangements and any precautions required for the use, storage and disposal of any recommended chemicals used for cleaning systems and equipment.

(d) Coating and maintenance instructions for water storage tanks.

(e) Cleaning instructions for filters, calorifiers and other equipment where bacteria may accumulate in fresh water systems for use of crew and embarked personnel and for food preparation.

(f) Maintenance instructions and fault finding procedures for the equipment and systems.

■ *Section 3*
System arrangements

3.1 Water storage facilities

3.1.7 Air, filling and sounding arrangements for fresh water storage tanks are to be located and arranged to prevent an ingress of ~~contamination.~~ a contaminant. The arrangements for filling are to include a deck connection to facilitate external loading.

Volume 2, Part 11, Chapter 2
Heating, Ventilation and Cooling Arrangements

Effective date 1 January 2010

■ *Section 1*
General requirements

1.3 Plans and information

1.3.6 **Operating manuals**. Operating manuals are to be ~~submitted for information and~~ provided on board and submitted for information where requested by LR. The manuals are to include the following information:

(a) Particulars and a description of the systems.

(b) Operating instructions for the equipment and systems (including fire isolation aspects).

(c) Maintenance instructions for the installed arrangements.

■ *Section 3*
System arrangements

3.1 General

(*Part only shown*)

3.1.2 The design and capability of supply and exhaust systems for ventilation purposes are to address the following requirements as applicable:

(b) Acceptable levels of fresh air are to be provided for personnel efficiency, combustion or other oxidation processes. The arrangements are to ensure that maximum CO_2 levels are not exceeded in all spaces where crew and embarked personnel are likely to be. ~~A maximum CO_2 level of 1200 ppm is to be adopted unless the Naval Authority specifies a greater or lesser level. A high level alarm is to be provided where 100 per cent recirculation is adopted for any ship operational requirement. A minimum fresh air flow of 5 litres/s/man is to be capable of being supplied to all spaces intended for crew and embarked personnel.~~ Unless specified by the Naval Authority:

(i) a maximum CO_2 level of 1200 ppm is to be adopted. A high level alarm is to be provided where 100 per cent recirculation is adopted for any ship operational requirement.

(ii) a minimum fresh air flow of 5 litres/s/man is to be capable of being supplied to all spaces intended for crew and embarked personnel.

Volume 2, Part 11, Chapter 3
Waste Systems

Effective date 1 January 2010

■ *Section 1*
General requirements

1.3 Plans and information

1.3.7 **Operating Manuals**. Operating Manuals are to be ~~submitted for information and~~ provided on board and submitted for information where requested by LR. The manuals are to include the following information:

(a) Particulars and a description of the systems.
(b) Operating instructions for the equipment and systems.
(c) Arrangements for the disposal of oily wastes from galleys.

Volume 3, Part 1, Chapter 3
Dynamic Positioning Systems

Effective date 1 January 2010

■ *Section 5*
Class notation DP(AAA)

5.1 Requirements

5.1.6 Where duplicated cables and pipes for services essential for the correct functioning of the DP system are installed in adjacent compartments, A-60 rated fire protection is to be provided between the spaces. Details of alternative arrangements which demonstrate essential equipment located in an adjacent space will continue to operate satisfactorily and essential services will continue to be available in the event of a fire in the adjacent space may be submitted for consideration.

Existing paragraphs 5.1.6 *to* 5.1.12 *are to be renumbered* 5.1.7 *to* 5.1.13.

Volume 3, Part 1, Chapter 4
Bridge Navigational Arrangements

Effective date 1 January 2010

■ *Section 1*
General requirements

1.1 General

1.1.1 The requirements of this Chapter apply to naval ships where an optional class notation for optimizing the environment on the bridge for navigational tasks, including periodic operation of the ship under the supervision of a single watchkeeper on the bridge and/or integrated bridge systems, is requested, and are additional to those applicable in other Parts of the Rules.

1.1.5 In general, ships complying with the requirements of Sections 1 to 4 of this Chapter will be eligible for the notation **NAV1**.

1.1.6 Section 5 of this Chapter states additional requirements which apply where the navigational functions are integrated. In general, ships complying with the requirements of Section 5 will be eligible for the notation **IBS**, *see* Vol 1, Pt 1, Ch 2,3.8.4. In addition to the assessment of the navigational function integration, the assignment of the notation **IBS** requires that the layout of the bridge and the equipment located on the bridge is to the satisfaction of LR, *see* 5.2.1.

■ *Section 3*
Workstations

3.1 Navigation workstation

3.1.4 The following facilities are to be provided at the navigation workstation:

- Radar and radar plotting facilities, *see* 3.1.5;
- position fixing system displays, *see* 3.1.6;
- echo sounder display;
- speed and distance indications, *see* 3.1.11 and 3.1.12;
- gyro compass display, *see* 3.1.7;
- magnetic compass display;
- wind speed and direction indication;
- steering controls and indication, *see* Pt 6, Ch 1,7;
- rate of turn indication;
- course/track controls and indications, *see* 3.1.8 to 3.1.10;
- main propulsion and thruster controls and indication, *see* Pt 9, Ch 1,2.6;
- watch safety system acknowledge;
- watch safety system manual initiation;
- internal communications system;
- VHF radiotelephone;
- time indication;
- window clear view controls;
- navigation lights controls;
- whistle control;
- morse light keys;
- wheelhouse/equipment lighting controls;
- automatic ship identification system (AIS) information;
- sound reception system where fitted, *see* 2.2.8.
- means to cease the distribution of long-range identification and tracking information, where arrangements in accordance with SOLAS Ch V, Reg.19-1,7 are installed.

■ *Section 5*
Integrated Bridge Navigation Systems – IBS notation

5.2 General requirements

~~*5.2.1* For assignment of the notation **IBS**, the layout of the bridge and the equipment on the bridge are to satisfy the requirements for assignment of the notation **NAV1** (Sections 1 to 4). Where the layout of the bridge and the equipment located on the bridge satisfy the requirements of a relevant international or national ergonomic or human centred design standard or an acceptable equivalent, compliance with the requirements of Sections 1 to 4 may be relaxed.~~

5.2.1 For assignment of the notation **IBS**, in addition to satisfying the other requirements of this Section:

(a) the layout of the bridge and the equipment located on the bridge is to satisfy the requirements of a relevant Naval, International or National ergonomic or human-centred design standard or an acceptable equivalent; or

(b) the notation **NAV1** is also to be assigned and the layout of the bridge and the equipment on the bridge are to satisfy the requirements of Sections 1 to 4; or

(c) where the bridge is not intended to operate a periodic one man watch, the layout of the bridge and the equipment on the bridge are to satisfy the requirements of Sections 1 to 4, with the exception that the requirements of 4.2 and 4.3 may be relaxed.

5.2.2 Where 5.2.1(a) is applicable, the submissions required by 1.2.1 are to include evidence demonstrating satisfaction of the requirements of an identified relevant standard.

5.2.3 To satisfy 5.2.2, the evidence submitted is to:

(a) include identification of testing necessary to verify compliance with the submitted test schedules for assessment by LR; or

(b) include relevant documentation demonstrating compliance with the relevant identified standard to the satisfaction of the Naval Authority. Such documentation is to be submitted prior to the assignment of the **IBS** notation. This may necessitate co-ordination of classification and Naval Authority Surveys, particularly for new construction, before the **IBS** notation may be assigned.

5.2.4 Where 5.2.1(c) is applicable, the submissions required by 1.2.1 are to include plans and information for the consideration of LR which demonstrate that the applicable requirements of Sections 1 to 4 have been satisfied.

Existing paragraphs 5.2.2 *and* 5.2.3 *are to be renumbered* 5.2.5 *and* 5.2.6.

5.3 Equipment

5.3.8 The centralised alarm system and the watch safety system required by 4.1 and 4.2 respectively are to be incorporated as functions of the integrated bridge system and are to be presented to the navigating officer via the conning display. The presentation and display of alarms is not to mask, obscure or degrade essential information displayed to aid navigational functions and maintain awareness of the navigational information, *see also* 5.5.

Volume 3, Part 1, Chapter 7
Replenishment at Sea (RAS) Systems

Effective date 1 January 2010

■ *Section 5*
Plans and particulars to be submitted

5.1 Plans and information

5.1.9 **Operating manuals**. Operating manuals are to be ~~submitted for information and~~ provided on board and submitted for information where requested by LR. The manuals are to include the following information:

(a) Particulars and a description of each RAS system.
(b) Operating and maintenance instructions for all equipment.
(c) Matrix of safe combinations of equipment and details of permitted load that may be carried by each combination.
(d) Test procedures for each system.
(e) Details of valve and pipe configurations when transferring fluids.
(f) Details of arrangements for transfer of solids and personnel.
(g) Details of night operations.

Volume 3, Part 2, Chapter 1
Noise and Vibration Levels in Personnel Spaces

Effective date 1 January 2010

■ *Section 2*
Noise

2.1 Maximum noise levels

2.1.1 Where the measured noise level exceeds ~~the specified criterion by 3 dB(A), or contains subjectively annoying low frequency or tonal components~~ the applied noise limit, the noise rating (NR) number is to be established in accordance with ISO 1999. If the NR number minus 5 dB(A) does not exceed the noise limit the requirement is fulfilled.

~~*2.1.2* For all stated noise levels, the equivalent NR number is evaluated as the measured dB(A) level minus 5 dB(A).~~

~~*2.1.3*~~ *2.1.2* Guidance on maximum acceptable sound pressure levels and noise exposure limits is given in IMO Resolution A.468(XII).

2.2 Crew and embarked personnel accommodation and work areas

Table 1.2.1 Accommodation – maximum noise levels, in dB(A)

Location	Ships greater than 200 tonnes lightship		Ships less than 200 tonnes lightship	
	Acceptance numeral			
	1	2	1	2
Sleeping cabins, hospitals	~~50~~ 52	60	55	60
Day cabins, Offices, conference rooms	55	65	60	65
Mess rooms	~~55~~ 57	65	60	65
Open deck work areas	~~65~~ 67	75	~~70~~ 72	75
Alleyways, changing rooms, bathrooms, lockers	70	~~80~~ 75	75	~~80~~ 75
NOTE The levels may be exceeded by 5 dB(A) within 3 m of a ventilation inlet/outlet or machinery intake/uptake on open decks.				

Table 1.2.2 Work areas – maximum noise levels

Location	dB(A) level
Machinery space (continuously manned) e.g. stores	90
Machinery space (not continuously manned) e.g. pump, refrigeration, thruster or fan rooms	110
Workshops	85
Machinery control rooms	75
Wheelhouse, conning positions and operational control rooms	65
Bridge wings, additional limits: 250 Hz octave band 500 Hz octave band	 68 (linear) 63 (linear)
Listening posts, including navigating bridge wings and windows	70
Radio rooms	60
Galleys and pantries: Equipment not working Individual items at 1 m	 ~~70~~ 75 ~~80~~ 85
Normally unoccupied spaces (e.g. holds, decks)	90
Ship's whistle, on bridge wings or forecastle	110

■ *Section 4*
Testing

4.2 Test conditions

4.2.1 Test conditions for the surveys are to be in accordance with those detailed in ISO 2923 and ~~ISO 4868~~ ISO 6954:2000.

4.3 Noise measurements

4.3.2 Where the measured noise exceeds the relevant criteria ~~by 3 dB(A)~~, or contains subjectively annoying low frequency noise, or obvious tonal components, octave band readings are to be taken, with centre frequencies from 31,5 Hz to 8 kHz.

4.3.3 Measurements are to be performed to evaluate the ship with respect to sound insulation, the measurement locations and quantity are to be agreed with LR.

4.5 Vibration measurements

4.5.1 Vibration measurements are to be conducted in accordance with ~~ISO 4868~~ ISO 6954:2000.

~~*4.5.3* Vibration levels are to be given in maximum repetitive peak values measured over a period of not less than one minute.~~

4.6 Vibration measurement locations

4.6.4 At all locations, vibrations in the vertical direction are to be assessed. Sufficient measurements in the athwartships and fore and aft directions are to be taken to define global ~~dock~~ vibrations.

■ *Section 5*
Survey reporting

5.1 General

5.1.2 The survey report shall be prepared by the organisation undertaking the trial measurements, which ~~may~~ is to be either LR or an approved technical organisation ~~or~~ approved by LR.

5.2 Noise

5.2.1 The reporting of results is to comply with ISO 2923, and is to include:

(a) The results of public address and general alarm system testing, in addition to the acoustic insulation testing.

(b) Measurement locations indicated on a general arrangement plan including, where possible, the measured dB(A) level.

(c) Tabulated dB(A) noise levels, together with octave band analysis for positions where the level exceeds the specified criterion ~~by 3 dB(A), or where subjectively annoying low frequency or tonal components are present~~. The NR number is also to be given where octave band analyses have been conducted. If the NR number minus 5 dB(A) does not exceed the noise limit the requirement is fulfilled.

(d) Ship and machinery details.

(e) Trial details:
- Loading condition.
- Machinery operating condition.
- Speed.
- Average water depth under keel.
- Weather conditions.
- Sea state.

(f) Details of measuring and analysis equipment (e.g. manufacturer, type and serial numbers), including frequency analysis parameters (e.g. ~~resolution~~, averaging time~~, window function~~).

(g) Copies of the relevant instrument calibration certificates, together with the results of field calibration checks.

■ *Section 8*
Referenced standard~~s~~

8.2 Vibration

8.2.1 The following National and International Standard~~s~~ for vibration are referred to in these Rules:

- ~~ISO 6954, *Mechanical vibration and shock – Guidelines for the overall evaluation of vibration in merchant ships.*~~
- ~~ISO 4868, *Code for the measurement and reporting of local vibration data of ship structures and equipment*.~~
- ISO 6954:2000*, Mechanical vibration – Guidelines for the measurement, reporting and evaluation of vibration with regard to habitability on passenger and merchant ships*.

Volume 3, Part 2, Chapter 3
Provision Refrigeration

Effective date 1 January 2010

■ *Section 1*
General requirements

1.2 Plans and information

1.2.6 **Operating manuals**. Operating manuals are to be ~~submitted for information and~~ provided on board and submitted for information where requested by LR. The manuals are to include the following information:

(a) Particulars and a description of the systems.

(b) Operating instructions for the equipment and systems (including fire isolation aspects).

(c) Maintenance instructions for the installed arrangements.

Cross-References

Section numbering in brackets reflects any Section renumbering necessitated by any of the Notices that update the current version of the Rules for Naval Ships.

Volume 2, Part 1, Chapter 2

1.2.3 *Reference* Pt 1, Ch 2,5.6 *now reads* Pt 1, Ch 2,5.7.
3.3.15 *Reference* 5.12.2 *now reads* 5.13.2.
4.12.11 *Reference* 5.11 *now reads* 5.12.
5.8.1 **(5.9.1)** *Reference* 5.8.2 *now reads* 5.9.2.
5.8.2 **(*5.9.2*)** *Reference* 5.8.1 *now reads* 5.9.1.
5.9.2 **(*5.10.2*)** *Reference* 5.9.1 *now reads* 5.10.1.
5.10.7 **(*5.11.7*)** *Reference* Pt 10, Ch 1,16.8.1 *now reads* Pt 10, Ch 1,16.9.1.
5.11.1 **(*5.12.1*)** *References* 5.11.2 to 5.11.10 *now reads* 5.12.2 to 5.12.10.
5.11.1 **(*5.12.1*)** *Reference* 5.12 *now reads* 5.13.

Volume 2, Part 2, Chapter 1

15.5.1(a) **(15.6.1(a))** *Reference* 2.11.2 *now reads* 2.12.2.
15.5.1(b) **(15.6.1(b))** *Reference* Pt 9, Ch 1,2.12.4 *now reads* Pt 9, Ch 1,2.13.4.
15.5.1(c) **(15.6.1(c))** *Reference* 2.12.5 *now reads* 2.13.5.
15.5.1(c) **(15.6.1(c))** *Reference* 2.9.4 *now reads* 2.10.4.

Volume 2, Part 2, Chapter 2

4.7.1 *Reference* Pt 1, Ch 2,5.11 *now reads* Pt 1, Ch 2,5.12.

Volume 2, Part 4, Chapter 4

8.1.6(b) *Reference* Pt 9, Ch 1,2.11 *now reads* Pt 9, Ch 1,2.12.
8.1.7 *Reference* Pt 9, Ch 1,2.12 *now reads* Pt 9, Ch 1,2.13.

Volume 2, Part 5, Chapter 4

1.3.1 *Reference* Pt 1, Ch 2,5.4 *now reads* Pt 1, Ch 2,5.7.

Volume 2, Part 9, Chapter 1

1.2.5 *Reference* 2.9.9 *now reads* 2.10.9.
1.2.5 *Reference* 2.11.6 *now reads* 2.12.6.
1.2.5 *Reference* 2.9.5 *now reads* 2.10.5.
1.2.5 *Reference* 2.11.3 *now reads* 2.12.3.
1.2.5 *Reference* 2.9.21 *now reads* 2.10.21.
1.2.5 *Reference* 2.12.2 *now reads* 2.13.2.
1.2.5 *Reference* 2.12.5 *now reads* 2.13.5.
2.2.7 *Reference* 2.9 *now reads* 2.10.
2.5.7 *Reference* 2.12.2 *now reads* 2.13.2.
2.6.8 *Reference* Pt 1, Ch 2,5.9 *now reads* Pt 1, Ch 2,5.10.
2.8.7 *Reference* 2.9 *now reads* 2.10.
2.9.1 **(*2.10.1*)** *Reference* 2.11 *now reads* 2.12.
2.9.1 **(*2.10.1*)** *Reference* 2.12 *now reads* 2.13 (twice).
2.9.2 **(*2.10.2*)** *References* 2.9 to 2.12 *now reads* 2.10 to 2.13.
2.9.5 **(*2.10.5*)** *Reference* 2.11.3 *now reads* 2.12.3.
2.9.6 **(*2.10.6*)** *Reference* 2.11.2 *now reads* 2.12.2.
2.9.6 **(*2.10.6*)** *Reference* 2.11.8 *now reads* 2.12.8.
2.9.9 **(*2.10.9*)** *Reference* 2.11.6 *now reads* 2.12.6.
2.9.11 **(*2.10.11*)** *Reference* 2.9.10 *now reads* 2.10.10.
2.9.12 **(*2.10.12*)** *Reference* 2.9.10 *now reads* 2.10.10.
2.10.1 **(*2.11.1*)** *References* 2.10.2 to 2.10.10 *now reads* 2.11.2 to 2.11.10.
2.10.3 **(*2.11.3*)** *Reference* 2.11.2 *now reads* 2.12.2.
2.11.1 **(*2.12.1*)** *References* 2.11.2 to 2.11.10 *now reads* 2.12.2 to 2.12.10.
2.12.1 **(*2.13.1*)** *References* 2.12.2 to 2.12.7 *now reads* 2.13.2 to 2.13.7.
2.12.7 **(*2.13.7*)** *Reference* 2.9.19 *now reads* 2.10.19.
2.12.7 **(*2.13.7*)** *Reference* 2.9.20 *now reads* 2.10.20.
4.1.1 *Reference* 2.11 *now reads* 2.12.
5.1.2 *Reference* 2.12.5 *now reads* 2.13.5.
5.2.1 *References* 2.9 to 2.12 *now reads* 2.10 to 2.13.
5.2.3 *Reference* 2.11.8 *now reads* 2.12.8.
5.3.1 *Reference* 2.9.19 *now reads* 2.10.19.
5.3.1 *Reference* 2.9.20 *now reads* 2.10.20.

Volume 2, Part 10, Chapter 1

1.2.1 *Reference* 1.2.14 *now reads* 1.2.15.
1.2.1 *References* 1.2.15 to 1.2.20 *now reads* 1.2.16 to 1.2.21.
1.13.2 *Reference* 1.12.5 *now reads* 1.12.6.
1.13.2 *Reference* 1.12.9 *now reads* 1.12.10.
1.15.1 *Reference* 16.5 *now reads* 16.6.
4.15.1 *Reference* Pt 9, Ch 1,2.11 *now reads* Pt 9, Ch 1,2.12.
10.5.1 *Reference* 10.8.8 *now reads* 10.8.10.
10.6.5 *Reference* 1.11.7 *now reads* 1.11.8.
10.8.19 **(*10.8.21*)** *Reference* 10.5.6 *now reads* 10.5.7.
10.14.1 *Reference* 1.11.6 *now reads* 1.11.7.
11.3.10 *Reference* 1.4.4 *now reads* 1.4.5.
11.7.2 *Reference* 1.4.4 *now reads* 1.4.5.
16.5.3 **(*16.6.3*)** *Reference* 16.5.2 *now reads* 16.6.2.

Volume 3, Part 1, Chapter 3

5.1.1 *Reference* 5.1.12 *now reads* 5.1.13.
2.4.1 *Reference* Vol 2, Pt 9, Ch 1,2.9 *now reads* Vol 2, Pt 9, Ch 1,2.10.

Volume 3, Part 1, Chapter 4

5.2.2 **(*5.2.5*)** *Reference* Vol 2, Pt 9, Ch 1,2.9, 2.10, 2.11 and 2.12 *now reads* Vol 2, Pt 9, Ch 1,2.10, 2.11, 2.12 and 2.13.

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